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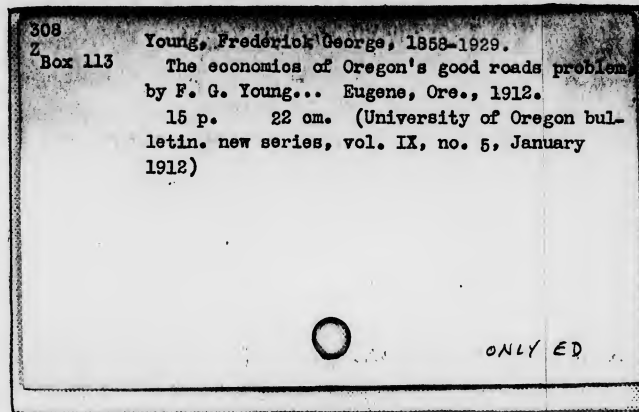
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THE ECONOMICS OF OREGON'S GOOD
ROADS PROBLEM

By

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Head of Department of Economics and Sociology, University of Oregon;
Secretary of the Oregon Conservation Commission



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A SUMMARY.

The good highway, smooth, hard and free from mud and dust, makes available to the farmer the best things of twentieth century life, so all roads must be maintained in the best condition possible.

Rapidly increasing transportation and tourist use of roads is subjecting them to destructive wear so that it is economic to construct more nearly permanent and costlier types adapted to bear this heavier traffic. Bituminous macadam should be substituted for earth and gravel roads as rapidly as traffic benefits warrant and where the highest order of need exists. This can be accomplished only through the best use of adapted road-building machinery and of highest engineering skill. Full employment of these and right planning of the highway system call for State organization of road improvement.

As all reap benefits from good roads all should bear proportionately the cost.

A highway system adequately and equitably planned and maintained and serving as an indispensable means to social uplift will become the object of zealous care of all.

THE ECONOMICS OF OREGON'S GOOD ROADS PROBLEM

I

AN OREGON GOOD ROADS PROGRAM.

PROPOSAL FOR THE OREGON SITUATION: Smooth, hard, dustless roads throughout the Oregon highway system, by means of appropriate betterment and maintenance of all roads.

All roads to be brought to a higher, or more nearly permanent, type of improvement as the traffic demands on each road stretch warrant the expenditures, and as the community is able to meet the cost.

A just apportionment of the costs of construction and maintenance among all who derive benefits from the road improvements.

An intelligent, hearty and general interest in realizing good roads aroused through a clear grasp of the course of procedure necessary to get an ideal highway system.

Highest efficiency of the community's good road efforts realized through active and zealous co-operation of all under the best organization of all the forces employed—labor, capital embodied in labor-saving road machinery essential for construction of higher types of roads; and the engineering skill that makes every stroke of work give largest and most lasting results.

The Combination of Factors That Spells Road Improvements.

The heretofore deplorably slow advance towards getting the roads up to the standards desired can only be due to the lack from among the supporting influences at work of some of the forces inherent in the community that must be enlisted to solve the good roads problem.

The following reinforcing elements of purpose, plan, sentiment, organization and methods, pertaining to road improvement, are proposed as effective for best results.

1. An adequate plan having in view the meeting of the primary transportation needs of all.

2. Adapted measures of improvement calculated to meet in the highest degree the various highway needs in the different sections of the community.

3. A just apportionment of the cost so that the patent justice in the distribution of the different types of construction and maintenance and the co-ordinate assignment of the burdens of expense appeal to all, thus evoking a spirit of co-operation and a sentiment towards the highways that will impel to the warmest zeal in improving and maintaining them.

4. Greatest efficiency of the community's effort in road improvement, reached through the best organization of the forces of engineering skill, labor-saving machinery, and hand labor applied at most favorable seasons.

5. Since rising standards of transportation demands characterize an advancing civilization, and the highways are being subjected to increasingly severer tests of traffic wear, and the proficiency of the road builder's art improves with the general advance of engineering science and invention, there is a call for progressive road improvement.

Experimenting agencies should be active in each county securing data, making careful practical tests, and conducting scientific investigations

on the highways in every locality that has conditions peculiar in climate and road materials.

Continuous study, prosecuted with rigorous scientific method, alone suffices to keep a community's road policy up to date.

In a word, *all motives and resources for road improvement should be brought into play*—the economic motive in the saving of transportation cost to the farmer, merchant and consumer, and in the enlarged production to which this leads; the country life uplift motive to which aim good roads will be the key; the tourist's recreational motive; and, last but not least, the social conservation motive which fosters the back-to-the-farm movement. The resultant of these forces will be a *product* rather than merely a *sum*. Such a degree of co-operation will multiply many fold the pace of progress in the attainment of good roads.

II

OREGON'S MOST PRESSING NEED.

Good roads, the prime requisite for a long stride of progress along all lines.

Sense of freedom, cleanliness and cheer would be given to life on the Oregon farms by good roads.

Brighter and more livable conditions of life on the farms in Oregon is our most pressing need today. Eliminate, to the easily attainable degree, the mud of the winters and the dust of the summers from the Oregon roads and the hardest part of the keep-on-the-farm and the back-to-the-farm problem would be solved.

Now the average country dweller suffers torture almost every time he ventures toward any center of population or into a social gathering and he is conscious of a bedraggled appearance as he arrives. This tends to beget a feeling that the farm is a hideous prison. The bad roads barrier shuts off the members of the farmer's household from relieving variety of experience and from opportunities of wholesome social intercourse. Leisure on the farm palls. Ennui and gloom become associated with the seasons that should suggest sunshine and joy.

The Farmer's Economic, Educational and Social Advantages Raised to Same Plane With Those of City Dweller.

So long as the present mud and dust road conditions prevail the maintenance of cheer inspiring neighborhood centers, the attainment of school advantages equal to those of the city and the opportunity of marketing farm products at times of highest prices and with lowest transportation cost are out of the question. Among the factors of the country life uplift the good roads problem is in the relation of the key. Secure control over it and the other factors necessary to redeem rural life conditions in Oregon are unlocked in quickest order.

Make the public highways the means of enjoyable recreation to the country dwellers as the urban pavements and the similarly improved stretches of rural highways are to favored city dwellers, and accomplish this through a rational and just policy of road improvement, and we may reasonably expect the effect upon country life to be such as will beget a general impulse to rise to a higher plane of living on the farm. There would result a determination to add to the natural advantages of the country the good things that heretofore have been the monopoly of the city.

The Tendency to an Increasing Contrast Between Rural and Urban Transportation Conditions Must Be Reversed.

With smooth, hard roads secured, concrete pavements for the farmer's door-yard and barn-yard would no longer be incongruous. When a mire of mud or a cloud of dust is encountered every time he steps outside his premises there is little utility in a few yards of hard pavement leading to his door. As it is the trail of slime and grime can hardly be blocked at the farmer's threshold. With good roads at his gates different ideals of cleanliness for clothes and floors and for furnishing the farm house in general would be possible and would be realized.

Oregon cities, large and small, are entering upon epochs of street paving. Their appearance is undergoing transformation. The contrast between urban and rural life conditions is thus being accentuated and added unto. The desire to escape from the country, unless a corresponding betterment is realized there, will be strongly reinforced.

With Full Promise of Relief the Response Will be Sweeping.

As yet farm communities are obsessed with a feeling that the redemption of the farm life environment is hopeless. In their beleaguered condition not only are the farmers largely deprived of those social advantages which constitute a large part of what is best in life, but they are also doomed to a desperate struggle to maintain a decent degree of cleanliness. The hope of rescue from all this will be born in them as soon as the attainment of good roads is clearly seen as possible—and not before.

An outline of the campaign that is easily within the farmers' power and which if undertaken would banish mud and dust from their roads engendering a sense of mastery of the situation and bringing them to a new attitude would multiply their needed power of socialized effort many fold. Concerted and scientifically directed efforts along the lines of their greater interests would then win the day.

A New Measure of Energy and Inventive Power Will Be Enlisted.

A parallel to the Oregon situation to-day, with the bad roads a ban on social progress, was exhibited in the industrial situation of England in the latter part of the eighteenth century. The spinning and weaving processes had to be accelerated and the iron producing industry given an impetus or England's future was narrowly limited. Industrial invention alone could open the way to the nation's onward march. The genius and enterprise of the English people were thus focused on these obstacles blocking the way of the nation's progress and they made short work in clearing the road. Inventions of the steam engine, spinning jenny, power-loom and the blast furnace came in quick succession, effecting an industrial revolution in which advance was made by leaps and bounds. In like manner it needs but be fully recognized that bad roads bar the possibility of Oregon's rural uplift and the measure of supporting forces that will be enlisted to give energy and inventive power for carrying out a rational and just plan of relief will give short shrift to the present mud and dust curse.

Highways, The Symbols of Community Helpfulness.

There are no difficulties involved in the good roads problem that a change from the now hopeless and helpless attitude to one of courage and co-operating zeal would not overcome. Substitute a spirit of

emulation in road improvement for one of shirking indifference and a dollar's worth and more of road would be realized for every dollar of tax expended.

A New Standard of Living on the Farm.

Kindle a hope of rescue where now there is supine acquiescence in a grimy envired existence, bring a spirit of elation that follows a glimpse of the promise of obtaining advantages the equal of those of the city folk in matters of school, church and recreation, and a wholly different standard of living will be realized on the farm. The road will become the symbol of the community's unity, strength and reciprocal helpfulness. The work necessary to secure a smooth, hard surface on all roads when all are eager to have a hand in the improvement will hardly cost a sense of effort.

The Roads of the Masses Must be the First Care.

The earth roads that constitute fully nine-tenths of the road mileage must be the first objects of the people's care. The tendency of long continued spells of rainy weather to cause them to become muddy and rough under travel and traffic can be forestalled through grading and drainage and with zealous care in maintenance when the elements are in arms against them. No doubt, too, an economic system of sprinkling or surfacing with oil, tar or asphalt can be devised to make the surface impervious and hence hard and smooth the winter through, as well as dustless for the summer. A little genuine study and zealous care applied to this problem will make it yield.

The Farmer's Winter Leisure Has Its Opportunity.

The Oregon farmer's comparative leisure in winter months affords time for this work of drainage and general maintenance. The surface of a road, once well-crowned, compact and drained needs but be kept in this condition, so as to serve as a roof, and all is well. Just the right application of some smoother in the shape of roller, grader, split-log drag, or shovel-in-hand, would work the miracle. The fact that even in mid-winter smooth hard spots are found on Oregon earth and gravel roads prove that the road as a whole might be so maintained. The good road spots occur where complete run-off of the precipitation takes place. Secure this shedding of the water from the drive-way as a whole, through appropriate grading and drainage and sprinkling and this type of Oregon road that is available throughout the most sparsely settled districts, may be kept smooth and hard and dustless the year round.

Organized Co-operation With the Engineer's Aid Will Lift the Oregon Farmer Out of Mud and Dust.

Community spirit and effort and a modicum of absolutely essential engineering aid are competent to bring into good condition, and to maintain so, probably some nine-tenths of our road mileage. But the main through-fares, the roads radiating from the population and market centers, must be of a higher type of the road builder's art. The bituminous macadams should be extended from the limits of the city pavements into the country as fast and as far as the community's financial strength suffice for. These bituminous macadams would certainly be found cheaper than the easily destroyed water bound now solely used.

Heretofore attention to the building of stretches of water bound macadamized roads has been synonymous with what has been known

as the "good roads movement." The construction of the highest type of roads wherever the volume of traffic warrants that measure of expenditure will always be an essential feature of well-balanced good roads activity; this line of effort should not, however, over-shadow other features quite as vital in an adequate good roads policy.

Our good roads problem stands as a challenge to evoke community effort. If so essential a *desideratum* to right living on the farm as good roads are, is tackled with spirit, and facility in co-operation gained, and the sweet and wholesome fruits of such co-operation tasted, other lines of common interest that call for the same exercise of the co-operative spirit and method will be taken up and a general rural uplift experienced.

III

THE MORE FUNDAMENTAL ECONOMICS OF THE GOOD ROADS PROBLEM.

Highways as Necessaries of Civilized Life Must be Good.

The highway need in a civilized community is virtually of the same order as the need of food, shelter and raiment, so a smooth, hard, dustless road, of a type of construction determined by the demands of the neighborhood traffic, is the right of every group of rural citizens. This means that all highways should be maintained in the best condition of which they are susceptible. Inability to construct a marble palace or a brown-stone front does not deter a sensible family from erecting the best protecting shelter it can afford. Likewise earth roads kept in the best condition, or gravel roads if they constitute the more economic investment and are also possible, must suffice until density of settlement and traffic warrant the higher classes of pavements.

Transportation Needs of The Farmer Paramount.

The transportation needs of the farmer for marketing, for schools, and for social recreations come first in order of importance. The tourist's demands for highways are important, the automobile having opened a new good roads era. But as for public roads, built with public funds, the needs of the tourist can be treated only as auxiliary. The users of motors have assisted in creating sentiment in favor of road improvement, which in itself is a public gain, still the real benefit of good roads, in comparison with which all other advantages from them sink into insignificance, lies in the saving to the farmers and to the merchants in which the general public of consumers may even share, of transportation cost and in the enhanced farm production which better marketing facilities engender.

Type of Road Built Determined by Character and Volume of Traffic.

Whether the road shall be an earth, gravel, macadam or paved highway is to be determined by the amount and character of the traffic it may develop. The amount of money that may justifiably be expended on any proposed improvement can only equal the return that construction will yield. The first cost, plus the annual maintenance charge, cannot exceed the annual traffic benefits multiplied by the number of years in the life of the improvement.

A Clearly Outlined Plan of Procedure for Developing Highway System Essential.

With the type of any proposed road improvement, adapted to the needs of any portion of a community, having been determined, the

attainment of it is much promoted through a policy that appeals to the sense of justice of all. The real and full worth of an ideal highway system can only with great difficulty be fairly appreciated by the average citizen, and as the first cost is great, he is deterred from supporting such construction unless the plan is clearly outlined and the procedure for realizing it well understood as not susceptible of perversion or failure.

Exclusive Attention to Permanent Improvement of Short Sections Not Enough.

The ideal of universally well-maintained roads, affording comfortable and economic facilities for travel and traffic for all sections of the community, is something of a repudiation of the idea that has controlled State highway policies for the last decade or two. It has been customary to place almost exclusive emphasis upon "permanent improvement" of short sections of the main travelled roads to the comparative neglect of the construction and maintenance of all others. In the last year or two, however, a marked tendency is to be observed among those states having had longest experience with state aid in the direction of extending the stimulus to road improvement to all types of highways. The general improvement of all the highways is more and more made the chief aim.

The Errors of the Customary State Policies of Road Improvement.

The mistakes that lay at the foundation of the past policy were:

1. Any road construction not of the "permanent" type was taken to be of no account; whereas rightly constructed and well-maintained earth and gravel roads serve some traffic needs just as well and much more economically than those of high cost. The earth and gravel roads upon which money had been largely wasted from time immemorial had never really been built or maintained.

2. The vital importance of maintenance was quite overlooked. Absolute necessity for it even on the so-called "permanent" roads was not appreciated. The expensive water bound macadam roads built in accordance with the demand of road improvement of the immediate past ravel out and are destroyed almost as rapidly as the old dirt roads were.

3. The almost complete ignoring of the traffic needs of those portions of the community not fully served by the improved stretches. This of itself surely vitiated this quite universal policy when adhered to in its stricter form. The event has proved that there is no such thing as a "permanent" road—at least the water bound macadam State aid roads purporting to be permanent have in many instances been badly worn through a single season's use under heavy automobile traffic.

A Sparsely Settled State Must Build Its Roads According to Its Means.

Nor would the policy of exclusively "permanent" road improvement have been salutary if the rate of building had been more rapid so that all might within some reasonable period have had such improvement. Any state may be made bankrupt by carrying out all of the desires for new and improved highways in sparsely settled communities. Oregon as a sparsely settled state, rapidly undergoing transformation through the filling up of different sections, presents an exceedingly difficult situation for safe and wise planning of high types of road improvement. However, the best drainage, grading, and maintenance for all roads is always an economic investment. The principles pertaining to this part

of road-building are well understood. But the rapid introduction of the automobile and other motor traction with their destructive wear of what were regarded as permanent roads left the highway engineers all at sea as to what was to be done for binding and surfacing the road metals. Recent careful experimenting and testing have made good progress towards solving the problem that the rapid travelling automobile created; still elaborate road-bed construction with borrowed funds is hazardous unless the plans used have been thoroughly tested.

High Initial Cost Roads Are the Cheap Roads Where Traffic is Heavy.

Where traffic is heavy expensive types of roads are the only economic construction. These require the use of highly specialized and costly machinery as well as the best engineering skill for planning and supervision. Hence organization and centralization of road improvement authority are necessary. As will be pointed out later this organization is also required to get system and adaptation of improvements to traffic requirements. But this centralization of administrative authority must proceed hand in hand with popular co-operation. The maintenance of the great portion of the road mileage of the community requires the zealous interest of all the users and the appropriation of funds for the more permanent types of improvement must be approved by the people.

Popular Enthusiasm and Co-operation Must be Wedded With Full Appreciation of Expert Service to Secure Good Highways.

The attainment of good roads for the varying traffic needs calls, therefore, for a high degree of discernment by the people. A part devolves upon them to do directly in enthusiastic emulation. The other portion can be effected only as it delegated to the expert and to the official with large and free authority. Progress in road improvement depends upon getting equitable plans so clearly outlined to the people that there will be enthusiastic response with co-operation, money and authority. A good roads policy must so forcefully commend itself to the public that the roads will symbolize the common weal, and become objects of community devotion eliciting patriotic zeal.

A Special Study of the Road Problem of Every Locality Will Produce the Best and Most Economic Roads.

Every locality is virtually under the necessity of making the most of the road building materials of its neighborhood. The cost of transportation limits the availability of sources of supply to short radii. This restriction does not, however, apply so rigidly to the use of bituminous substances used as binders in surfacing macadam. Climatic conditions, too, affect adaptability of methods and materials. It follows, therefore, that the development of the peculiar process of construction adapted to local materials and conditions calls for persistent study and experimenting in each locality. Only through such experimenting and carefully noted observations of the results can most serviceable and economic methods of building and maintenance be obtained.

The Automobile on the Roads Raises a New and Grave Problem.

The substitution to a large degree of motor for animal traction, and other changes in the volume or character of the traffic may work havoc with existing road improvements, even on those that had been regarded as permanent. The dismay of France over the destructive effect of the automobile traffic on the roads that had been her pride for centuries caused her to call in 1908 the first International Good Roads Congress.

The same problem as to the use of binding materials that would withstand the strain of this new form of traffic was also the leading topic of discussion at the second congress held at Brussels in 1910. Where the evolution of new forms and volumes of traffic is so rapid as is now being witnessed in Oregon this phase of the problem of retaining the equilibrium between the road and its traffic calls for particular attention.

Necessary Use of Road Building Machinery Makes Larger Administrative District Advisable.

There is much saving of labor cost and great gain in the quality of the road produced through the use of highly effective road building machinery. For that matter, the rock crushers, spreading dump cars and ten-ton rollers, with other even more specialized forms of machinery, have made the higher types of road construction possible. Since an outfit of this machinery represents a large investment of capital, and as single sets suffice for the needs of considerable areas, the administrative unit for road construction and maintenance should comprise an extensive territory. The Oregon county is a much better unit than any fraction of it would be.

The Highways of a State Are an Organic Whole.

Furthermore, the wide ranging marketing areas and the rapidly increasing tourist use of the roads by the people of the cities bring the highways of the State into the relation of an organic whole. Every part of the State has a stake in the condition of the roads of every other portion. In this fact is found the equity of the system of State aid that has recently been widely adopted.

The Special Character of the Western Oregon Road Problem Due to a Wet and a Dry Season.

Western Oregon shares with Western Washington certain peculiar climatic conditions that have to be taken into account in a fully adjusted system of road improvement and maintenance. The protracted rainy weather of the winter months and the almost rainless summer months divide the year into a wet and a dry season. The problem of keeping the surface, especially of the earth roads, hard and free from ruts and mud during the winter and from having it ground up into a deep layer of dust during the summer is found nowhere else probably in a more obdurate form. It may be impossible to obviate the necessity of having some impervious coating for the surfaces of all roads in this region. But the efficacy of careful grading, close patrolling, together with some advisable restriction in traffic at critical times, has never been tested.

No Slavish Imitation of Eastern Policies Will Secure Economic Highways For Oregon.

Because of peculiarities of climate and of rock materials available for the roads of the different sections the good roads problem of Oregon cannot be solved, in the sense of securing best possible highways at least cost, through any slavish imitation of the policies and practices of other states. The Oregon situation demands a careful analysis of the elements of the problem and such adaptation of the results of the experience in road improvement conducted elsewhere as the local factors call for. Direct study with scientific care of the situations presented by each distinct locality cannot be dispensed with.

The Farmers and the Automobilists Must Get Together on a "Community Good" Platform.

The cause of good roads has had earnest and able support in many counties in Oregon. The highways in these exhibit a fairly high state of improvement. There is now an intense interest in a general advance to a higher plane with this means of public welfare. The good roads movement in the State has, however, developed symptoms of a snarl. Advocates of trunk line or trans-state road improvements have incurred the suspicion of those representing the agricultural communities. There is a tendency towards a grouping into a state road or Pacific Highway party and a party insisting upon improvement first of the highways radiating from market towns and population centers. Something of a deadlock exists. As has already been intimated the deeper community interest calls for serving the farmers' need first. Everybody has a stake in the cheapened cost of transportation of agricultural products and in the larger production that follows a readier access to markets. The tourist interest is served through the connecting of the radial roads proceeding from the different centers.

Why a Right State Aid Policy is Best.

The old county unit organization of road improvement exhibits a promising degree of activity here and there in the State, but it has not the benefit of the stimulus, the expert aid, the larger support and the virtue of higher organization, that State aid would supply. The general pace of improvement throughout the State is not what the rapidly advancing need calls for; nor do the policies pursued in the several counties reveal the purpose and plans that are in most complete harmony with the larger interests the people have at stake in road improvement.

That the good roads problem is essentially a State problem rests on several economic grounds. Two-thirds of the states of the Union are handling it as such and their experience strongly vindicates the following claims: A more nearly equitable distribution of the costs is thus realized. Aid from the State treasury disbursed to meet provision of local quotas stimulates to more active road-building. The different types of improvement are more closely adapted to traffic needs throughout the State. The largest use of expert service in planning and supervising the road construction is secured. Wherever the good roads problem is tackled with the determination to advance to a higher plane in the handling of it a new recruit to the contingent of state-aid states appears.

The federal government has long had its part in collecting data, making laboratory tests, giving good road building demonstrations and maintaining other forms of good roads propagandism, and in Oregon the county has had the brunt of the responsibility for providing the people with roads; it would surely be anomalous if the State government, which stands between, should not have a normal share in a rationally organized system of road improvement.

The Adequate Aim in Highway Improvement.

The larger relations of good roads to country life uplift are getting recognition. The need of clearness on the influence of the conditions of the highways on the economic, educational and social welfare is for the first time being realized. Roads are coming to be regarded as an investment for returns not only in increased wealth, but also in higher intelligence, greater general happiness and the largest participation in the social inheritance of the twentieth century. It is for this reason

that for the first time we hear the slogan: "All roads must be maintained." "To maintain and conserve is more important than merely to build." "Thorough, careful, continuous repair is the word. To spend the people's money to construct highways, and then let them immediately become inefficient for lack of care, is a crime."

Furthermore, road improvement as a strenuous collective or social enterprise is greatly promoted if purpose and plan recommend themselves to the people, eliciting whole-hearted and enthusiastic support. The achieving power of the investment is thereby multiplied many fold.

IV

PRACTICAL SUGGESTIONS FOR ROAD BUILDING BASED UPON ECONOMIC GROUNDS.

Is a New Departure Needed?

Other things being equal an upward movement should be an evolution. Existing practices and policies should be utilized as far as serviceable. The largest use is thus made of experience. The new light of theory should be introduced as a modification of accustomed methods.

The Present County System Weighed and Found Wanting.

Taking this attitude towards the Oregon highway situation, we observe some counties already investing as heavily in road-building as traffic benefits warrant. In other words, a full proportionate share of the social income is used on their roads. The road tax levies in these counties are near the maximum limit. To have recourse to a sale of long term bonds for road funds, when the county has proven that it cannot build roads that will last a small fraction of the years for which the money was borrowed is too much like stealing bread away from one's own children.

The showing of these counties in road construction is creditable and yet but a small portion of the traffic is free from the dust and mud curse. And moreover, their so-called "permanent" roads either must be built differently or maintained differently. They show serious impairment from wear. The necessary inference from all this is that it will not do simply to put forth a little more of the same kind of good roads effort already exemplified in those Oregon counties that lead in road improvement. Their experience affords little or no hope of general salvation from mud and dust. Furthermore, the Oregon county road system would not bear the tests pertaining to equitable apportionment of costs, to needed application of engineering principles, to advantage obtained from local experiments.

Wherein the State Organization and State Aid in Vogue Have Come Short.

It has been argued that the good roads problem is essentially a State problem, calling for the organization of a State system of road improvement. The experience of the eastern states that have given State organization and aid a thorough trial fully demonstrates the truth of this claim. During the last eighteen years two-thirds of the states have turned from local to State administration of road improvement; and the only one that ever turned back had not given the State system a real trial.

But the adoption of the organization and policy of some eastern states will not end all of our Oregon road troubles. State aid as such

was not a cure-all in any of the state-aid commonwealths. They are gradually awakening to the fact that they went wrong on a too nearly exclusive attention to permanent improvement of short stretches of the main travelled roads. The introduction of the automobile traffic began to play havoc with their supposedly permanent state roads. They are busy resurfacing their water bound macadam with some tar or bituminous applications and their new roads built for heavy traffic are practically all bituminous macadam roads.

Advisability of Proposed Road Construction Must be Judged on The Basis of Its Being an Investment.

However, the recently re-adjusted road policy of a state like New York could not serve as a model for sparsely settled Oregon. The traffic over probably nine-tenths of our road-mileage will not bear a type of construction higher than that of good earth or gravel roads. The suggestion that Oregon use her credit, say to the extent of a \$20,000,000 loan, is a hazardous one. If we could be sure of building roads adapted to the traffic as it is to develop on the different highways so that the investment would be paying and permanent, and if we could build now at not more than twice the cost at which the roads could be built, when actually demanded, all would be well with the bonding scheme. Any large use of the credit of the State at this time of transition in Oregon and in the road-building art would indeed be a rash venture.

Guiding Principles.

We are sure that all roads should be maintained in their best condition; that a higher type of road, as nearly permanent as the road engineer's art can make it, should be built where the traffic demands it on the roads radiating from the market and population centers. Then how shall we provide the system of financing, of adequately planning and of organizing for the construction and maintenance of such roads?

County Road Maps; Records of Construction and Maintenance; Traffic Statistics.

There can be no planning of a highway system of any county as an integral part of a state system, without as complete information as possible of the existing roads, their types of construction and statistics of the traffic they bear. The county road maps should indicate the type of road improvement of every mile of county roads. The records of road construction in the county and of road maintenance and the results of experiments and investigations should be put into the most available form. Because of the probable lack of traffic statistics the arrangement or location of the roads in their relations to population and market centers may have to be relied upon to indicate the type of construction on the different stretches necessary to stand the traffic wear.

Cost Per Mile Per Annum During Life of Improvement The Unit of Cost Measurement.

In making a selection of a type of construction it must be kept in mind that a road is essentially an investment to secure returns in traffic benefits. But the cost per mile per annum throughout the life of the improvement with the volume and character of traffic advantages secured, must be weighed against each other—and not merely the initial costs—when it is a question between a higher or a lower type of construction.

Plan of Apportionment of Cost to be Based on Full Range of Benefits Given.

In providing the funds, the plan of apportionment of the cost should take into account the full range of the benefits that will accrue from the new construction. Not only will the users as carriers, and the tourists enjoy benefit but also all those who share in the advantage coming from lower costs of transportation. This means some equitable state-aid system.

Economy in Full Use of Invention and Expert Service.

Wise and full use of inventions embodied in road-building machinery and of science available in services of engineers is necessary to secure most economic road construction. The higher types of roads are quite impossible of construction without the aid of this machinery and of the engineer's art. Only the highest type of construction will answer at all where the traffic is heavy. Furthermore, the cost of the machinery and of the engineer's services is brought to the lowest figure where each, the machinery and the engineer, is given full employment. This calls for the larger unit of organization.

Provision for Improvement of Continuous Through Lines of Travel.

While the systems of roads radiating from the market centers in each county should constitute the basis of the planning for road improvement provision should be made for securing the connection of the systems of adjoining counties into continuous and direct routes.

The American Folly of Neglect of Maintenance Should End.

Since the great American highway blunder has been the neglect of road maintenance every effort should be made to stimulate the development of maintenance plans, maintenance organization and maintenance activity.

The System of Apportionment of State Aid Funds and The Constitution of State Highway Commission Are The Fundamental Features of a State Aid System.

Each state has natural conditions and has developed institutions and traditional practices in connection with its highway system that call for special features in a highway code well-adjusted to it. Still there are characteristics which are fundamental in all normally constituted state aid systems. These are:

1. A just apportionment of the State aid funds is provided for. Among the methods used in distributing aid to localities making road improvements are the following:

(a) The State Highway Commission is left free to determine the distribution among the counties, excepting that it cannot exceed a certain maximum or use less than a certain minimum in any county; or

(b) Counties receive equal sums; or

(c) Counties receive sums in proportion to their respective assessed valuations; or

(d) The money is divided on the basis of the total number of miles of road in each; or

(e) *Pro rata* with amounts asked for.

The nearest approximation to justice is probably attained through a combination of these methods. The following basis of apportionment recommends itself as most equitable: One-third on the basis of assessed valuation, one-third on the basis of area, one-third on the basis of equal distribution among the counties.

2. Every state giving state aid authorizes its state highway officers to say what methods of work shall be followed and how the roads shall be constructed. Through this provision a dollar's worth of road is obtained for every dollar of tax.

Probably the most important part of the state aid law is that which prescribes the form of the state commission. This body has general control of all the activities of highway construction and maintenance. The composition of this commission determines whether or not the State highway work shall be controlled by political considerations with resulting inefficiency of actual road building or whether it shall be controlled entirely in the interest of efficient road work without regard to political considerations. The following types of highway departments are to be found:

(a) One State highway commissioner or engineer appointed by the Governor for a definite term of years.

(b) A commission of three men paid for their full time and appointed by the Governor for a definite term of office.

(c) A commission appointed by the Governor for a definite term of office, but serving without pay and giving only general direction to the work, which is under the active direction of a State engineer selected and hired by them for a period coincident with satisfactory service.

(d) An *ex officio* board composed, for instance, of the State Geologist and the professors of civil engineering of the leading colleges of the State.

(e) A combination of the last two types is probably the most desirable as it includes both business ability and experience and expert service with freedom from politics.

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